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Silhouette Towards Mendeleev's Periodic Table and Significance

Suman Verma
Research Scholar
Shri Venkateshwara University
Gajraula, U.P., India

Dr. Pradeep Kumar
Associate Professor
Shri Venkateshwara University
Gajraula, U.P., India

Abstract

Modern day periodic tables are expanded beyond Mendeleev's initial 63 elements. Most of the current periodic tables include 108 or 109 elements. It is also important to notice how the modern periodic table is arranged. Although we have retained the format of rows and columns, which reflects a natural order, the rows of today's tables show elements in the order of Mendeleev's columns. In other words the elements of what we now call a 'period' were listed vertically by Mendeleev. Chemical 'groups' are now shown vertically in contrast to their horizontal format in Mendeleev's table. It is also worthy to note that Mendeleev's 1871 arrangement was related to the atomic ratios in which elements formed oxides, binary compounds with oxygen whereas today's periodic tables are arranged by increasing atomic numbers, that is, the number of protons a particular element contains.

Although we can imply the formulas for oxides from today's periodic table, it is not explicitly stated as it was in Mendeleev's 1871 table.

Keywords: Mendeleev Periodic Table, Chemical Elements, Periodic Table, Usage Patterns of Periodic Table

Introduction

In 1869, just five years after John Newlands put forward his Law of Octaves, a Russian chemist called Dmitri Mendeleev published a periodic table. Mendeleev also arranged the elements known at the time in order of relative atomic mass, but he did some other things that made his table much more successful.

In the mid-1700s, chemists began actively identifying elements, which are substances made up of just one kind of atom. But a century later, they still used a variety of symbols and acronyms to represent the different materials — there just wasn't a common lexicon. In 1869, the Russian chemist Dmitri Mendeleev came to prominence with his tabular diagram of known elements. This basic ingredient list, of which all matter exists, became known as the periodic table. Here's what's especially amazing: Mendeleev's chart allotted spaces for elements that were yet to be discovered. For some of these missing pieces, he predicted what their atomic masses and other chemical properties would be. When scientists later discovered the elements Mendeleev expected, the world got a glimpse of the brilliance behind the periodic table.

Mendeleev did not develop the periodic table entirely on his own; he inherited and built on knowledge that was handed down from many chemists who spent their lives investigating matter. In the early 1800s, about 30 elements were known, and although chemists knew that some of these elements acted in similar ways or had similar characteristics, no one had found an overall, accepted pattern in their behaviors.

In 1860, scientists met at one of the first international chemistry conferences. They decided that hydrogen, the lightest element, be given a weight of 1. All other elements' weights would be compared to that of a hydrogen atom. That means that if an element is eight times heavier than hydrogen, its weight is 8. The concept of a systematic measure for atomic weights greatly contributed to the success of Mendeleev's periodic table.

In 1864, with about 50 elements known, the British chemist John Newlands noticed a pattern when he arranged the elements in order of atomic mass, or weight. He found that the properties of the elements seemed to repeat every eighth element. He called this the Law of Octaves, comparing it to musical scales. His ideas were rejected, and his peers joked that he may as well have arranged the elements in alphabetical order. After calcium (20 on today's periodic table), Newlands' order went amiss. He had grouped the very unreactive metal copper in the same group as the highly reactive elements lithium, sodium, and potassium. Far away in Russia, Mendeleev did not know about Newlands.

As can happen in scientific developments, another researcher arrived at the same theory as Mendeleev's at about the same time. In 1870, German chemist Julius Lothar Meyer published a paper describing the same organization of elements as Mendeleev's. Both scientists had similar backgrounds: They had studied in Heidelberg, Germany, in the laboratory of the chemist Robert Bunsen. Both had attended, in September 1860, the first international chemistry congress in Karlsruhe, Germany. The congress had addressed the need to establish a common system to measure the weights of the different elements. And both chemists were teachers working on textbooks for their students.

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Whatever the case, Mendeleev's periodic table, with placeholders strategically saved for upcoming discoveries, provided invaluable scaffolding to classify the building blocks of matter. The spaces he reserved reflected a confidence, also, in the ongoing search for knowledge.

The periodic table did not immediately impact the field of chemistry, though that changed with the discovery of the first missing element, gallium, in 1875. All of its qualities fit those Mendeleev had foreseen for the element he called eka-aluminum. As invaluable a reference tool as it was, the periodic table left plenty of room for discovery and enhancement. In the 1890s, an entirely new and unexpected group of elements was detected: the noble gases. They were added to the table as a separate column. Helium, the second-most abundant element in the Universe, wasn't found on Earth until 1895. Another 60 or so elements have since been discovered and others may still be waiting to be found. Beneath the contiguous periodic table, you can see two rows known as the "lanthanides" (atomic numbers 57–71) and "actinides" (atomic numbers 89–103), named after the first, left-most members of their groups. As scientists found the heavier elements and began to create many more, the newer elements have been separated to keep the table's cohesive shape. As of 2012, the periodic table has a total of 118 elements. Some elements have been named after scientists, such as atomic number 99, Einsteinium,for Albert Einstein. Rutherfordium, atomic number 104, is named in honor of physicist Ernest Rutherford, who developed the modern model of the atom. Atomic number 101, Mendelevium, is named after the periodic table's architect. Mendeleev's periodic table presented a new paradigm, with all of the elements positioned within a logical matrix.

Conclusion

The elements are arranged in a series of rows called "periods," so that those with similar properties appear in vertical columns. Each vertical column is called a "group," or family, of elements. This instantly shows one set of relationships when read up and down, and another when read from side to side. Some groups have elements sharing very similar properties, such as their appearance and their behavior. For example, each element has its own melting and boiling point, the temperatures at which it changes from a solid to a liquid and from a liquid to a gas. Another characteristic is how "reactive" an element is, meaning how quick it is to join up with other elements. Scientists recognize how an element will react based on its location on the table. The elements are known by an atomic symbol of one or two letters. For example, the atomic symbol for gold is "Au," the atom's name is "gold," and its atomic number is 79. The higher the atomic number, the "heavier" an element is said to be. Hydrogen is 1 on the periodic table, in the upper left corner. Its atomic number is 1; its nucleus contains one proton and one electron. About 98 percent of the Universe consists of the two lightest elements, hydrogen and helium.

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